TERMINAL BLOCKS AND METHODS FOR MAKING AND BREAKING CONNECTIONS IN A TELECOMMUNICATIONS CONDUCTOR

Field of the Invention

The present invention relates generally to telecommunications and, more particularly, to connecting devices and methods for connecting telecommunications conductors.

Background of the Invention

Terminal blocks are used by telecommunications companies to connect connector wires of a multi-core cable to service wires that extend to customer residences or places of business. Such terminal blocks are typically mounted outdoors and are, thus, exposed to environmental conditions, such as rain, snow, sleet, ice, temperature fluctuations, dirt, insect infestation and similar conditions that may adversely affect the electrical connections between the service wires and the electrical connectors. Thus, some form of sealant material may be provided in such terminal blocks.

Referring now to the schematic illustration of **FIG. 1**, a typical telephone company (Telco) telecommunications conductor cable **20** extends from the Telco central office **22** to feed pedestals in a neighborhood or neighborhoods. The Telco telecommunications conductor cable **20** may include as many 900 or more pairs of telecommunications conductor wires. At a splice **24**, one or more of the pairs of

telecommunications wires are accessed. **FIG. 1** illustrates a single tip line **26** and ring line **28** which are spliced at the splice **24** into a cable extending to pedestal **32**. Note that, while only one pair of wires **26, 28** is illustrated, the splice typically includes bridge connections for 25 pairs of wires with a 25 pair cable **30** extending from the splice **24** to the pedestal **32**. Thus, the telecommunications wire pair **26, 28** and the other 24 pairs which are bridge connected to the pedestal **32** also continue to extend within the telecommunications conductor cable **20** and are, therefore, available for use at additional pedestals further downstream from the Telco central office **22**.

In the pedestal **32**, the telecommunications wire pair **26, 28** is connected to a terminal block **34**. It is further to be understood that, while only one terminal block **34** is illustrated, a terminal block assembly including a plurality of module stations, which may share a common base, is typically provided for all the pairs of the cable **30**. The terminal block **34** provides a connection point between telecommunications wire pair **26, 28** and the customer service wires **36**. A telecommunications connection may thus be provided between the customer **38** and the Telco central office **22**. In addition, by utilizing a bridge connection at the splice **24**, the telephone company maintains the flexibility of using ones of the pairs of wires in the telecommunications conductor cable **20** at different pedestals **32** depending upon customer requirements at various locations within a neighborhood or neighborhoods.

An example of terminal blocks **34** according to the prior art is described in United States Patent No. 5,557,250 entitled "Telecommunications Terminal Block" which is incorporated herein by reference as if set forth in its entirety. Telecommunications terminal blocks may also be utilized for establishing a connection between internal wiring of the customer **38** and the customer service wires **36**. An example of such a telecommunications terminal block is described in United States Patent No. 5,423,694 entitled "Telecommunications Terminal Block" which is incorporated herein by reference as if set forth in its entirety.

The telecommunications infrastructure as described with reference to **FIG. 1** is generally directed to providing conventional voice services to a plurality of customers **38**. The conductors **20, 26, 28, 36** are typically copper wires well suited to supporting voice communications. With the increased popularity of data based communications, which are typically digital transmissions, additional demands are being placed on the telephone infrastructure. For example, the Internet is growing increasingly popular with expanding information and services available to customers utilizing the Internet. The increase in content and opportunity for utilization of the Internet further may make it desirable to provide increasing data rates for communications over the telephone infrastructure.

While conventional modems designed for use over the telephone infrastructure are suited to the systems described with reference to **FIG. 1**, they are typically limited in their communication rate, for example, to 56 kilo bits per second (kbps). More recently, the digital subscriber line (DSL), very high data rate DSL (VDSL), asymmetrical DSL (ADSL) and other DSL technologies have been proposed for bringing higher band width information communications to homes and small businesses over ordinary copper telephone lines such as the cable infrastructure illustrated in **FIG. 1**. The DSL approach is intended to provide downstream communications connections at data rates from approximately 1.544 megabits per second (mbps) through 384 kbps. However, the data rate available for any individual customer **38** may depend upon a variety of characteristics of the Telco infrastructure including the distance between the customer **38** and the Telco central office **22**. The unused length of a customer's telecommunication wire pair, such as pair **26, 28**, extending downstream from the splice **24** may further limit the data rate available to individual customers.

Summary of the Invention

In embodiments of the present invention, telecommunications terminal blocks are provided for making and breaking connections between a first

telecommunications conductor, a second telecommunications conductor and a service wire. The terminal block includes a housing having a first connector connected to the first telecommunications conductor and a second connector connected to the second telecommunications conductor mounted therein. A first conductor is provided in the housing, the first conductor being electrically connected to the first connector and having a service wire connector portion configured to receive the service wire. A switch electrically connects the first connector and the second connector, the switch having a first state wherein the first connector is electrically connected to the second connector and a second state wherein the first connector is electrically disconnected from the second connector.

In other embodiments of the present invention, the switch includes a third connector mounted adjacent the second connector in the housing, the first connector being electrically connected to the third connector, and a select module positioned over the second connector and the third connector, the select module having a first position electrically connecting the second connector and the third connector and a second position wherein the second connector and the third connector are not electrically connected. The select module may include a housing and a jumper conductor mounted in the housing of the select module, the jumper conductor having, when the select module is in the first position, a first end positioned to contact the second connector and a second end positioned to contact the third connector.

In further embodiments, the first connector comprises a first end of a longitudinally extending member and the first conductor comprises an opposite end of the longitudinally extending member. The housing of the terminal block may include a base having a first portion and a second portion, the longitudinally extending member being mounted in the first portion with the first conductor extending from an upper surface of the base, the second connector and the third connector being mounted in the second portion of the base. A movably mounted service wire connector member may be positioned adjacent the upper surface of the

base in the first portion, the service wire connector member including a service wire receiving passageway that receives a service wire for connection to the first conductor. The service wire connector member may have a first position that provides access to an opening to the service wire receiving passageway to receive a service wire and a second position wherein a portion of the service wire receiving passageway passes through an opening in the first conductor. The housing of the select module may be mounted to the base adjacent the second portion. The first conductor may be an insulation displacing connector and the service wire connector member may be rotatably mounted to the base to insert a service wire in the passageway into the insulation displacing connector. The housing of the select module may be mounted to the base in a first orientation in the first position of the select module and in a second orientation in the second position of the select module. The second orientation may be substantially a 180° rotation from the first orientation.

In other embodiments of the present invention, the first telecommunications conductor is a tip conductor from a telephone company central office and the second telecommunications conductor is a tip conductor extending from the terminal block downstream from the telephone company central office and the service wire is a tip service wire from a user premise. The terminal block further includes a ring input connector mounted in the first portion of the base of the housing of the terminal block connected to a corresponding ring conductor from the telephone company central office paired with the tip conductor. A ring output connector is mounted in the second portion of the base of the housing of the terminal block connected to a corresponding ring conductor extending from the terminal block downstream from the telephone company central office paired with the tip conductor extending from the terminal block downstream from the telephone company central office. A ring conductor electrically connected to the ring input connector extends from the upper surface of the base of the housing of the terminal block in the first portion. A ring jumper connector is mounted in the

second portion of the base of the housing of the terminal block adjacent the ring output connector, the ring jump connector being electrically connected to the ring input connector. The select module includes a second jumper conductor mounted in the housing of the select module, the second jumper conductor having, when the select module is in the first position, a first end positioned to contact the ring output connector and a second end positioned to contact the ring jumper connector. The service wire connector member further including a second service wire receiving passageway that receives a ring service wire for connection to the ring conductor, the service wire connector member having a first position that provides access to an opening to the second service wire receiving passageway to receive the ring service wire and a second position wherein a portion of the second service wire receiving passageway passes through an opening in the ring conductor.

In yet other embodiments of the present invention, a ground connector is mounted in the second portion of the base of the housing of the terminal block. An electrical protection device is positioned in the housing of the select module so as to be electrically connected between the jumper conductor and the ground connector and between the second jumper conductor and the ground connector. In further embodiments, the base of the housing of the terminal block is elongate and includes a plurality of termination stations, the termination stations having respective first portions and second portions, tip and ring input connectors, tip and ring output connectors, tip and ring service wire conductors, select modules and service wire connector members to provide a multi-station terminal block.

In further embodiments of the present invention, the housing of the terminal block includes a base having a first portion and a second portion, the first connector and the first conductor being mounted in the first portion with the service wire connector portion extending from an upper surface of the base, the second connector being mounted in the second portion of the base. A movably mounted service wire connector member is positioned adjacent the upper surface of the base in the first portion, the service wire connector member including a service

wire receiving passageway that receives a service wire for connection to the first conductor, the service wire connector member having a first position that provides access to an opening to the service wire receiving passageway to receive a service wire and a second position wherein a portion of the service wire receiving passageway passes through an opening in the service wire connector portion of the first conductor. A contact member electrically connected to the second connector and extends from the base of the housing of the terminal block and contacts the first conductor. An actuator is positioned in the service wire connector member so as to allow the contact member to contact the first conductor in the first position of the service wire connector member and to break the contact between the contact member and the first conductor in the second position of the service wire connector member. The contact member may be a first end of an elongate conductive member and the second connector may be a second end of the elongate conductive member. The actuator may be a cam.

In yet further embodiments of the present invention, terminal blocks for making and breaking connections with a telecommunications conductor are provided. The terminal blocks include a base having a first connector and a second connector mounted therein. A first conductor extends from the base, the first conductor being electrically connected to the first connector. A second conductor also extends from the base, the second conductor being electrically connected to the second connector. A service module is provided which is configured to be removably mounted to the base. The service module includes a service wire connector configured to receive a customer telecommunications conductor and a contact member that electrically connects the service wire connector to the first conductor when the service module is mounted to the base. The first conductor and the second conductor are configured so as to electrically connect the first connector and the second connector when the service module is removed from the base. The service module is configured to interrupt the electrical connection of the

first connector and the second connector when the service module is mounted to the base.

In further embodiments of the present invention, the contact member is configured to disconnect the electrical connection of the first connector and the second connector when the service module is mounted to the base. The service wire connector may be a first end of a longitudinally extending conductive member positioned to receive the customer telecommunications conductor and the contact member may be a second end of the longitudinally extending conductive member. The second end of the longitudinally extending conductive member may contact the first conductor when the service module is mounted to the base. The service module may include a conductor chamber and the service wire connector may be positioned in the conductor chamber. A passageway may extend into the conductor chamber having an opening for receiving the customer telecommunications conductor and be positioned to pass the customer telecommunications conductor to the service connector.

In other embodiments of the present invention, the first conductor is positioned adjacent to the second conductor so as to contact the second conductor when the service module is removed from the base. The service module may further include a nonconductive member positioned to pass between the first conductor and the second conductor when the service module is mounted to the base. The first conductor and the second conductor may comprise a spring clip. In various embodiments, the nonconductive member extends from a bottom surface of the service module adjacent the base. The contact member may include an electrically conductive layer on a surface of the nonconductive member adjacent the first conductor when the service module is mounted to the base and a connector that electrically connects the electrically conductive layer to the service wire connector. In other embodiments, the nonconductive member includes a channel in a surface thereof adjacent the first conductor when the service module is

mounted to the base and the contact member is received in the channel of the nonconductive member.

In further embodiments of the present invention, the first connector is a first end of a second longitudinally extending conductive member and the first conductor is a second end of the second longitudinally extending conductive member. The second connector is a first end of a third longitudinally extending conductive member and the second conductor is second end of the third longitudinally extending conductive member. The service wire connector may be an insulation displacing connector.

In other embodiments of the present invention, the service module includes a base portion defining a conductor chamber. A cover may be rotatably connected to a first end of the base portion on a top portion thereof displaced from the base of the terminal block. A passageway in the cover may extend into the conductor chamber, the passageway having an opening on a second end of the cover opposite the first end for receiving the customer telecommunications conductor. The passageway may be positioned to pass the customer telecommunications conductor to the insulation displacing connector. Rotation of the cover to a closed position may connect the customer telecommunications conductor to the insulation displacing connector.

In further embodiments of the present invention, the terminal block further includes a third connector and a fourth connector mounted in the base. A third conductor may extend from the base, the third conductor being electrically connected to the third connector, and a fourth conductor may extend from the base, the fourth conductor being electrically connected to the fourth connector. The fourth conductor and the third conductor may comprise a second spring clip. In other embodiments the service module further includes a second service wire connector configured to receive a second customer telecommunications conductor and a second contact member that electrically connects the second service wire connector to the third conductor when the service module is mounted to the base.

The second spring clip may electrically connect the third connector and the fourth connector when the service module is removed from the base and the second contact member may be configured to electrically disconnect the first connector and the second connector when the service module is mounted in the base.

In other embodiments of the present invention, the nonconductive member includes a second channel in a surface thereof adjacent the third conductor when the service module is mounted to the base and wherein the second contact member is received in the second channel of the nonconductive member. The second channel and the first channel may be in opposite surfaces of the nonconductive member. The first and second customer telecommunications conductors may be tip and ring lines. A line protector may be electrically connected between the first conductor and the third conductor in the service module when the service module is mounted to the elongate base.

In further embodiments of the present invention, the second service wire connector is a first end of a fourth longitudinally extending conductive member positioned to receive the second customer telecommunications conductor and the second contact member is a second end of the fourth longitudinally extending conductive member, the second end of the fourth longitudinally extending conductive member contacting the third conductor when the service module is mounted to the base. The first longitudinally extending conductive member may include a circuit connector and the fourth longitudinally extending conductive member may include a second circuit connector, the circuit connector and the second circuit connector being positioned to receive an electrical device therebetween.

In other embodiments of the present invention, the base is elongate and defines a first axis and the first spring clip is positioned adjacent and laterally offset from the second spring clip with reference to the first axis. A plurality of service modules may be removeably mounted to the elongate base along the first axis. The base may include an elongate chamber and the first spring clip and the

second spring clip may be positioned in the elongate chamber. An environmental sealant, such as a gel, may be included in the elongate chamber and in the conductor chamber. The plurality of service modules may include clip members and the elongate base may then include a plurality of clip receptacles spaced along the first axis and configured to receive the clip members to mount the service modules to the elongate base.

In further embodiments of the present invention, the service module includes a conductor chamber and an environmental sealant in the conductor chamber. The service wire connector and the second service wire connector may be positioned in the conductor chamber. The service module may include a circuit contact member that electrically connects to the second conductor when the service module is mounted to the base. The circuit contact member may be configured to electrically connect an electrical device between the first connector and the second connector.

In other embodiments of the present invention, a telecommunications terminal block for making and breaking connections with a telecommunications conductor is provided. The terminal block includes a base having a first connector and a second connector mounted therein. A first conductor extends from the base, the first conductor being electrically connected to the first connector. A second conductor extends from the base, the second conductor being electrically connected to the second connector. A service module is configured to be movably mounted to the base for movement between a first position adjacent the base and a second position displaced vertically from the base. The service module includes a service wire connector configured to receive a customer telecommunications conductor and a contact member that electrically connects the service wire connector to the first connector when the service module is in the first position. The first connector and the second connector are configured so as to electrically connect the first conductor and the second conductor when the service module is in the second position. The service module is configured to interrupt the electrical connection of

the first conductor and the second conductor when the service module is in the first position.

In further embodiments of the present invention, methods are provided for making and breaking connections with a telecommunications conductor. X pairs of telecommunications conductor wires from a telecommunications conductor cable extending from a central office facility are severed. The telecommunications conductor cable has more than X pairs of telecommunications conductor wires. A first end of the severed X pairs of telecommunications conductor wires is connected to a first group of X pairs of wires and a second end of the severed X pairs of telecommunications conductor wires is connected to a second group of X pairs of wires. The first and second group of X pairs of wires are extended to a telecommunications customer service wire junction box. Ones of the first group of X pairs of wires are selectively connected to at least one of a pair of customer service wires or one of the second group of X pairs of wires in the customer service wire junction box.

In other embodiments of the methods of the present invention, the customer service wire junction box is a telephone company pedestal and the X pairs of telecommunications conductor wires are severed at a splice, such as a buried splice closure. The number, X, of pairs of wires may be 25. In various embodiments selectively connecting includes leaving corresponding ones of the second group of X pairs of wires disconnected from ones of first group of X pairs of wires which are connected to a pair of customer service wires. Corresponding ones of the second group of X pairs of wires may be connected to ones of first group of X pairs of wires which are not connected to a pair of customer service wires.

In further embodiments of the present invention, telecommunications terminal blocks are provided for making and breaking connections with a telecommunications conductor. The terminal blocks include a base having a first connector and a second connector mounted therein. A first conductor extends from the base, the first conductor being electrically connected to the first connector. A

second conductor also extends from the base, the second conductor being electrically connected to the second connector. The terminal blocks further include means for electrically connecting a service wire connector to the first conductor and for interrupting the electrical connection of the first connector and the second connector when the first conductor is connected to the service wire connector and means for electrically connecting the first connector and the second connector when the first conductor is not connected to the service wire connector.

In other embodiments of the present invention, telecommunications terminal blocks are provided for making and breaking connections with a severed telecommunications conductor. The terminal blocks include means for connecting to a first end and a second end of the severed telecommunications conductor. The terminal blocks further include means for connecting the first end to a customer service wire and disconnecting the first end from the second end when the first end is connected to the customer service wire and for connecting the first end and the second end when the first end is not connected to the customer service wire.

In yet other embodiments of the present invention telecommunications terminal blocks are provided for making and breaking connections between a telecommunications conductor and a service wire. The terminal block includes a housing having a first connector and a second connector mounted therein, the first connector being electrically connected to the telecommunications conductor. A first conductor is provided in the housing, the first conductor being electrically connected to the second connector and having a service wire connector portion configured to receive the service wire. An electrical protection device electrically connects the first connector and the second connector. The electrical protection device may be a fuse circuit. The housing may include a base having a first portion and a second portion, the first conductor being mounted in the first portion with the service wire connector portion extending from an upper surface of the base, the first connector and the second connector being mounted in the second portion of the base, the second connector being mounted adjacent the first connector. A

movably mounted service wire connector member may be positioned adjacent the upper surface of the base in the first portion, the service wire connector member including a service wire receiving passageway that receives a service wire for connection to the service wire connector portion, the service wire connector member having a first position that provides access to an opening to the service wire receiving passageway to receive a service wire and a second position wherein a portion of the service wire receiving passageway passes through an opening in the service wire connector portion. A protection module may be mounted to the base adjacent the second portion, the electrical protection device being positioned in the protection module.

Brief Description of the Drawings

FIG. 1 is a schematic view of a terminal block in a telephone company pedestal connected to customer service wires and to a telecommunications conductor cable from a central office according to the prior art;

FIG. 2 is a schematic view of a terminal block according to embodiments of the present invention in a telephone company pedestal connected to customer service wires and to a telecommunications conductor cable from a central office;

FIGs. 3A and **3B** are perspective views of telecommunications terminal blocks according to embodiments of the present invention;

FIG. 4 is an exploded perspective view of a telecommunications terminal block according to embodiments of the present invention illustrating components of the base;

FIGs. 5A and **5B** are perspective views of a service module according to embodiments of the present invention having covers in an open position to received customer service wires and a closed position to terminate customer wires respectively;

FIG. 6 is an exploded perspective view of a service module according to the present invention including a line protector device;

FIG. 7 is an exploded perspective view of the service module of **FIG. 6** with a wall of the base portion removed;

FIGs. 8A and **8B** are cut-away perspective views of a telecommunications terminal block according to embodiments of the present invention with the service module mounted to the base and removed from the base respectively;

FIGs. 9A and **9B** are cut-away perspective views of a telecommunications terminal block according to further embodiments of the present invention with the service module in a first position adjacent the base and a second position displaced from the base respectively;

FIGs. 10A and **10B** are cut-away perspective views of a telecommunications terminal block according to further embodiments of the present invention with a select module in a first position through connecting telecommunications conductor wires and a second position disconnecting the telecommunications conductor wires;

FIGs. 11A and **11B** are cut-away perspective views of the telecommunications terminal block of **FIGs. 10A** and **10B** including an electrical protection device with the select module in a first position through connecting telecommunications conductor wires and a second position disconnecting the telecommunications conductor wires;

FIG. 12 is a cut-away perspective view of a telecommunications terminal block according to further embodiments of the present invention;

FIG. 13 is a cut-away perspective view of a telecommunications terminal block according to yet further embodiments of the present invention including an in-line electrical protection device;

FIG. 14 is an exploded perspective view of a 25 station telecommunications terminal block according to embodiments of the present invention;

FIG. 15 is an exploded perspective view of a 50 station telecommunications terminal block according to embodiments of the present invention;

FIGs. 16A and **16B** are cut-away perspective views of a telecommunications terminal block according to further embodiments of the present invention with a select module in a first position through connecting telecommunications conductor wires and a second position disconnecting the telecommunications conductor wires;

FIGs. 17A and **17B** are cut-away perspective views of a telecommunications terminal block according to further embodiments of the present invention with a service wire connector member in a first position through connecting telecommunications conductor wires and a second position disconnecting the telecommunications conductor wires; and

FIG. 18 is a flowchart illustrating operations for making and breaking connections with a telecommunications conductor according to embodiments of the present invention.

Detailed Description of the Invention

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout. In the drawings, layers, objects and regions may be exaggerated for clarity.

The present invention will now be described with reference to the embodiments illustrated in the figures. Referring first to **FIG. 2**, a schematic view of a terminal block according to embodiments of the present invention in a

telephone company pedestal connected to customer service wires and to a telecommunications conductor cable from a central office will now be described. The telecommunications conductor cable **50**, typically a copper wire cable, extends from the Telco central office **52** to a neighborhood or neighborhoods where customer service is desired. At a splice **54**, a plurality of pairs of telecommunications wires are accessed to bring connections to the pedestal **62**. The splice **54** may be an underground splice or an above ground splice. Similarly, the pedestal **62** may be provided as a surface mounted pedestal, an overhead suspended pedestal or a buried pedestal. However, pedestals **62** are generally located at ground level at various locations throughout the neighborhood or neighborhood serviced by the telecommunications conductor cable **50**.

The connections at the splice **54** to individual wires in the telecommunications conductor cable **50** are schematically illustrated with reference to a single pair of wires **56, 58**. As shown in the embodiments of **FIG. 2**, wires **56, 58** are severed and their corresponding counterpart wires **56', 58'** continue to extend downstream from the splice **54** in the telecommunications conductor cable **50** to be available to other pedestal. It is to be understood, however, that a plurality of wire pairs, typically 25 pairs, will be accessed at the splice **54** and routed to the pedestal **62** to provide service access to a plurality of customers **68**. As is further illustrated in **FIG. 2**, each of the wires **56, 58, 56', 58'** is routed to the pedestal **62** by cable **60**. For example, where 25 wire pairs are accessed at the splice **54**, cable **60** may be a 50 pair cable. Alternatively, various other cable configurations, such as two 25 pair cables, may be provided for cable **60**. In any event, in accordance with the present invention, both ends of at least one telecommunications wire, including the end extending to the Telco central office **52**, shown as **56, 58** in **FIG. 2**, and the end extending downstream, shown in **FIG. 2** as wire **56', 58'**, is extended to the pedestal **62**. As illustrated in **FIG. 2**, each telecommunications wire accessed at the splice **54** has both ends of the accessed telecommunications wire routed to the pedestal **62**. However, in keeping with the present invention, it

is to be understood that one or more of the telecommunication wires accessed at the splice **54** may be routed to the pedestal **62** using a bridge connection as was described previously with reference to **FIG. 1**.

At the pedestal **62**, one or more terminal blocks **64** in accordance with embodiments of the present invention are provided. While a single terminal block **64** is shown in **FIG. 2** for illustrative purposes, it is to be understood that a plurality of such terminal blocks **64** may be provided in a terminal block assembly. A plurality of service modules may be associated with one or more base units mounted in the pedestal **62** to provide the plurality of terminal blocks **64**. For example, where 25 pairs of telecommunication wires are accessed at the splice **54**, a single base supporting up to 25 service modules may be provided as will be described further herein.

As shown in the embodiments of **FIG. 2**, the terminal block **64** may provide a connection from the central office **52** between the telecommunications wire pair **56, 58** and the customer service wire **66** to provide a connection to the customer **68**. In addition, the first end of the telecommunication wires **56, 58** extending from the Telco central office **52** may be connected to the corresponding telecommunications wires **56', 58'**, thereby maintaining an electrical connection from the Telco central office **52** through to downstream locations on the telecommunications conductor cable **50** more remote from the Telco central office **52** than the splice **54**. The wires **56, 58** may be directly connected to the wires **56', 58'** as illustrated by the dotted lines within the terminal block **64** in **FIG. 2**. Alternatively, circuitry can be placed between the wires **56, 58, 56', 58'**.

Referring now to **FIG. 3A,** embodiments of a telecommunications terminal block according to the present invention will now be further described. The telecommunications terminal block assembly **100**, as shown in the embodiments of **FIG. 3A** provides 25 telecommunications terminal blocks for making and breaking connections with a telecommunications conductor. As shown in **FIG. 3A**, two stations of the telecommunications terminal block assembly **100** are configured as

operative terminal blocks with the inclusion of service modules **110**. As shown in **FIG. 3A**, the service modules **110** are configured to be removably mounted to a base **107** configured to support up to 25 service modules **110**. Each terminal station within the base **107** may include a first and a second pair of connectors to support tip and ring line connections. The connectors may be mounted in the base **107** so as to allow each station of the base **107** to be wired to an incoming and an outgoing connection for wires in cable **105**. For example, a first connector in a base **107** at a first station may be connected to a wire **56** and a second associated connector mounted in the base **107** at the first station may be wired to a corresponding telecommunications wire **56'**. The connections of the connectors mounted in the base **107** to wires from the cable **105** may be provided by the manufacturer of the telecommunications terminal block assembly **100** which may then be sold with a pigtail type cable **105**. The connections may be a variety of means such as wire wrap, insulation displacing connectors or post type connectors. The base **107** may include a bottom (or base) portion **115** and a top portion **125**. The service modules **110** are shown mounted adjacent the top portion **125**. An end wall **120** of the base portion **115** may include a connector **150** for securing the cable **105** to the base **107**. Each of the service module receiving terminal stations of the base **107**, as shown for the embodiments of **FIG. 3A**, includes a front latch opening **140** and a back latch opening **135** as well as a latch lever **145**. The latch openings **135** and **140** are configured to receive associated latches of service modules **110** for mounting the service modules **110** to the base **107**. An opening **130** is further provided in the top surface **125** for the terminal stations to allow the service modules **110** access to the connectors within the base **107**.

Further embodiments of telecommunications terminal blocks according to the present invention are illustrated in **FIG. 3B**. The telecommunications terminal block assembly **200** is illustrated with 25 terminal stations, each configured to support one of the service modules **210**. The openings **230**, **240** and the latch **245** operate substantially as described previously with reference to the openings **130**,

140 and latch **145** with reference to **FIG. 3A** and will not be described further herein. The base **207**, as shown in **FIG. 3B**, includes a bottom (or base) portion **215** and a top cover **225**. The openings **242** in the top cover **225** may provide access for components in the service modules **210** to connections, such as a ground strip, in the base **215** and/or to facilitate alignment of the service modules **210**. The end wall **220** of the base **207**, as shown in **FIG. 3B**, includes a connector assembly **250** for connecting to the cable **205**.

As will be apparent to those of skill in the art from **FIGs. 3A** and **3B** and subsequent figures to be described herein, the terminal block assembly **200** of **FIG. 3B** differs from the terminal block assembly **100** of **FIG. 3A** in, among other things, the latching mechanism and the design of the service modules **110, 210**. Similarly, the top cover **225** illustrated in **FIG. 3B** mounts over the base **207** and the connector assembly **250** includes a chamber which may be suitable for providing mechanical support and/or environmental sealing for the conductor cable **205**.

The base **207** will now be further described with reference to the illustration of **FIG. 4**. As shown in the illustrated embodiments in **FIG. 4**, a longitudinally extending member **300** and a longitudinally extending member **302** are mounted in the bottom portion **215** of the base **207**. The longitudinally extending conductive member **302** includes a connector **310** on a first end thereof and a conductor **312** on a second end thereof. The longitudinally extending conductive member **300** similarly includes a conductor, a portion of which is visible in **FIG. 4**, on a first end thereof and a connector on a second end thereof (not shown). The conductor **312** and the conductor of member **300** extend from the base **207** with the conductor **312** being electrically connected to the conductor end of connector **300**. As shown in **FIG. 4**, the conductor **312** and the connector **310** each extend longitudinally in opposite directions and at right angles to a connecting plate portion **313**. The longitudinally extending conductive member **300** may be similarly configured.

The conductor end of the longitudinally extending member **300** and the conductor **312** are configured so as to electrically connect the connector **310** and the connector (not shown) of the longitudinally extending conductive member **300** when the service module **210** is removed from the base **207**. The conductor **312** and the corresponding conductor of the longitudinally extending conductive member **300** thus comprise a spring clip as shown for the embodiments of **FIG. 4**. In other words, the first conductor **312** and the associated conductor portion of member **300** are positioned in adjacent relationship so as to make contact when the service module **210** is removed from the base **207**.

Each terminal station (two of which are shown in **FIG. 4**) for the embodiments of **FIG. 4** includes connections for two wires, for example, of a tip and ring wire (or line). Thus, the described members **300** and **302** may be associated with a first (tip or ring) line and additional longitudinally extending conductive members **304, 306** may be associated with a second (ring or tip) line of the pair of wires associated with a terminal station of the base **207** and an individual service module **210** mounted in the terminal station. As seen in **FIG. 4**, the member **304** may include a connector **314** at a first longitudinally extending end thereof and a conductor **316** at an opposite end. Thus, members **304, 306** may be configured as described previously with reference to members **300, 302**.

The conductors **312, 316** (and the conductor ends of members **300, 306**) are shown positioned in an elongate chamber **320** of the base **207**. The elongate chamber **320** is defined by the sidewalls **338, 340** and the bottom wall **318**. The members **300, 302, 304, 306** as shown in **FIG. 4** are mounted in the bottom wall **318** with the connectors **310, 314** positioned in longitudinally extending slots **322** and **324**, respectively.

As shown in **FIGs. 3A, 3B** and **4**, the base **207** extends along a first axis **L** (*see* **FIG. 4**). The spring clip defined by the conductors of members **300** and **302** is positioned adjacent and laterally offset from the spring clip defined by two conductors of members **304** and **306** with reference to the axis **L**. The terminal

stations for the respective service modules **210** are positioned along the axis **L**. However, it is to be understood that the respective spring clips need not be laterally offset and can be placed along the axis **L** and further may be laterally aligned, as contrasted with the longitudinal offset between the first and second spring clips as shown in the illustrated embodiments of **FIG. 4**. However, the illustrated offset relationship may facilitate the packaging size requirements of the telecommunications terminal block assembly **200**.

The top cover **225**, as illustrated in **FIG. 4**, includes a downwardly extending skirt portion **332** configured to wrap around the bottom portion **215**. A channel **336** is positioned to receive the sidewall **338** of the bottom portion **215** and a channel **334** is configured to receive the sidewall **340** of the base portion **215**. the openings **328** in the bottom portion **215** are configured to receive the clip **350** of the service module **210** when it passes through the corresponding opening **240** in the top cover **225** and to receive the member **352** passing through the opening **242** in the cover **225**. An elongate channel **330** may be configured to receive the member **352**. The member **352** may be a conductive member and the channel **330** may be positioned to guide the conductive member **352** into contact with a ground bus positioned in the base **207**. The member **352** may further facilitate alignment between the service module **210** and the base **207**.

The service module **210** in the illustration of **FIG. 4** further includes a nonconductive member **354** extending from a bottom face of the service module **210** and a contact member **356** positioned in a channel on a surface of the nonconductive member **354**. The nonconductive member **354** and the contact member **356** pass through the opening **230** when the service module **210** is mounted to the base **207**. The contact member **356** may thus be placed in contact with the conductor **316** of the member **304** while, at the same time, a portion of the nonconductive member **354** is positioned between the members **304** and **306** to interrupt the electrical connection therebetween when the service module **210** is mounted to the base **207**.

Referring now to the embodiments illustrated in **FIG. 5A** and **FIG. 5B** of a service module according to the present invention, the service module **110** is shown in an open position in **FIG. 5A** and a closed position in **FIG. 5B**. The service module **110**, as illustrated in the embodiments of **FIG. 5A** and **FIG. 5B**, includes a base portion **400** which defines a conductor chamber and a cover **402** which is rotatably connected to the base portion **400** as shown in **FIGs. 5A** and **5B**, the cover **402** is rotatably connected to an end **404** of the base portion **400** by a hinge **406**. As can be seen in **FIG. 5A**, when the cover is rotated to the open position, openings **408, 410** are provided to allow customer service wires **409** to be passed into passageways in the cover **402**. The cover **402** may be latched in a closed position by the latch **412**.

Referring now to the illustrations of **FIGs. 6, 7, 8A** and **8B** generally, further embodiments of a service module **110, 210** according to the present invention will be further described. As shown for the illustrated embodiments in **FIGs. 6** and **7**, the service module **210** includes a base portion **500** defining a conductor chamber **501** and a cover **502** rotatably connected to an end **504** of the base portion **500** on a top portion **505** thereof. As shown in the figures, the cover **502** rotatably connects to the hinge **506** with a bracket **508**.

Longitudinally extending conductive members **520** and **540** are also illustrated. As shown, longitudinally extending conductive member **520** includes a service wire connector **522** at a first end thereof positioned to receive customer telecommunication conductors, such as the customer service wires **409**, and a contact member **524** at a second end thereof. A connecting portion **526** connects the service wire connector **522** and the contact member **524** that respectively extend longitudinally in opposite directions and at right angles thereto. In addition, a circuit connector **528** extends from the connector portion **526**. Similarly, the member **540** includes a service wire connector **542**, a contact member **544** and a circuit connector **548**. An electrical device **550**, such as a line protector (for example, a gas tube or a varistor) may be positioned electrically connecting

between the circuit connectors **528** and **548** to place an electrical device across the respective pair of tip and ring lines. The service wire connectors **522, 542** may be insulation displacing connectors as illustrated in **FIG. 6**.

The contact members **524, 544** may respectively make electrical connection with the member **300** and the member **304** (*see* **FIG. 4**) when the service module **210** is mounted to the base **207**. The contact members **524, 544** may, thus, respectively electrically connect customer service wires placed in the service module **210** to the members **300, 304** respectively. For the illustrated embodiments, as best seen in **FIG. 7**, the contact member **524** is positioned in a slot **359** of the nonconductive member **354** while the contact member **544** is positioned in a slot **358** on an opposite surface of the nonconductive member **354**. This configuration may provide for disconnection of the electrical connection between members **300** and **302** and members **304** and **306** respectively when the service module **310** is mounted to the base **207**. Alternatively, electrical contact areas could be placed on opposing sides of the nonconductive member **354** to allow electrical connections to each of the members **300, 302, 304** and **306** to allow electronic circuitry to be placed in circuit to interrupt the electrical connection of the incoming and outgoing telecommunications conductor wires, such as wires **56** and **56'** or wires **58** and **58'**. Similarly, while shown as a conductive member in a channel of a nonconductive member, the contact members **524** and **544** may be provided as conductive coatings on a surface of the nonconductive member **354** and a connector, such as a spring loaded conductive member, may be provided to electrically connect the electrically conductive layers on the nonconductive member **354** to the service wire connectors **522, 542**.

The service connectors **522, 542** are positioned in the chamber **501** and an environmental sealant, such as a gel, may be placed therein to facilitate environmental protection for the connections between the customer service wires and the service wire connectors **522, 542**. An environmental sealant may also be placed in the elongate chamber **320** of the base **207** to facilitate environmental

protection of connections between the members **300, 302, 304, 306** and the contact members **524, 544**. An environmental sealant may also be placed in the chamber **326** of the base **207** to facilitate environmental protection of the connection between wires of the cable **205** and the respective connectors, such as connectors **322, 324**. The environmental sealant may be a gel such as those disclosed in United States Patent Nos. 4,634,207 and 4,864,725 which are incorporated herein by reference as if set forth in their entirety. As the connections to the conductor cable **205** generally need not be made and broken on a repeating basis, the environmental sealant in the chamber **326** need not be re-entrable. For example, a potting compound may be used.

The top cover **502**, as shown in **FIG. 7**, includes passageways **560, 562** extending into the conducting chamber **501**. The passageways have respective openings **564, 566** therein for receiving customer telecommunications conductor wires. The passageways **560, 562** are positioned in the cover **502** to pass the customer telecommunications conductor wires to the service wire connectors **522, 542**. As shown in **FIG. 7**, slots **570, 572** define a portion of the conductor chamber **501** and are positioned relative to the service wire connectors **522, 542** so as to receive the service wire connectors **522, 542** therein when the cover **502** is rotated into a closed position on the base **500**. Thus, customer service wires may be extended into the passageways **560, 562** and positioned in the slots **570, 572** so as to be driven into the insulation displacing connectors of the service wire connectors **522, 542** when the cover **502** is rotated into a closed position. As shown in **FIG. 7**, the passageways **560, 562** include stub ends **574, 576** at an end thereof to facilitate retaining the customer service wires in the passageway **560, 562** during establishment of electrical connections.

Referring now to the exploded perspective cut away views of **FIGs. 8A** and **8B**, terminal blocks according to various embodiments of the present invention including a service module **110** configured to be removably mounted to the base **107** for making and breaking connections with a telecommunications conductor

will now be further described. Service wires **808** and **810** are received in the service module **110**. For purposes of the description herein, service wire **808** will be referred to as the ring line and service wire **810** will be referred to as the tip line. However, it is to be understood that the tip and ring lines may be interchanged and/or other telecommunications wires may be utilized. In a typical customer environment, the customer telecommunications conductor (or service) wires **808, 810** extend from the terminal block to the customer location, such as a telephone RJ11 jack or a network interface device (NID) typically mounted on the wall of a customer premise. A first, or tip, telecommunications conductor **806** and a first, or ring, telecommunications conductor **802** are received in the base **107**, such as from an underground or above ground splice in a telecommunications conductor cable having multi-pair wires.

Tip and ring in lines **806, 802** are received in respective connectors **314'**, **311'**. Connector **314'** is on a first end of longitudinally extending conductive member **304'** which, in turn, is placed in electrical contact with conductor **540'** when the service module **110** is latched into the base **107** as described previously. Tip output line **804** and ring output line **800** are electrically connected to respective connectors (**310'** shown) and run from the base **107** to the respective splice location described previously with reference to the tip and ring in lines **806** and **802**. Accordingly, as can be seen best with reference to **FIG. 8B**, when the module **110** is removed from the base **107**, the respective tip in **806** and tip out **804** lines are electrically connected and the corresponding respective ring in **802** and ring out **800** lines are connected whereas, as illustrated in **FIG. 8A**, the in lines are connected to the customer service telecommunications wires **808, 810** and the connection to the tip and ring out lines are broken.

Further embodiments of the present invention are illustrated in the cross-sectional diagrams of **FIGs. 9A** and **9B**. As with **FIGs. 8A** and **8B**, the terminal blocks illustrated in **FIGs. 9A** and **9B** are shown in an engaged and a disengaged position respectively. Like numbered components in **FIGs. 9A** and **9B** operate as

described previously with reference to **FIGs. 6, 7, 8A** and **8B** and will not be described further herein. However, the embodiments illustrated in **FIGs. 9A** and **9B** are movably mounted to the base **307** between a first position, as shown in **FIG. 9A**, and a second position, as shown in **FIG. 9B**. The electrical connection characteristics of the respective wires for the first position substantially correspond to the mounted position as illustrated in **FIG. 8A** and the second position substantially correspond to the removed position illustrated in **FIG. 8B**.

As shown in **FIGs. 9A** and **9B**, the service module **309** is mounted in a chamber of the base **307** and longitudinally movable between an up position, as shown in **FIG. 9B**, and a down position, as shown in **FIG. 9A**, with the respective electrical connections to the tip and ring lines being substantially identical to those described previously with reference to **FIG. 8A** and **FIG. 8B**.

Further embodiments of the present invention will now be described with reference to **FIGs. 10A, 10B, 11A** and **11B**. **FIGs. 10A** and **10B** differ from **FIGs. 11A** and **11B** in the inclusion of an electrical protection device **870** and a ground connection **872** in the illustrations of **FIGs. 11A** and **11B**. **FIGs. 10A** and **11A**, respectively, show a first position, in which the respective telecommunications conductor in lines **802, 806** are electrically connected to corresponding telecommunications connector out lines **800, 804** while **FIGs. 10B** and **11B**, respectively, show a second position in which the tip and ring output and input lines are electrically disconnected. Note that, in all of **FIGs. 10A-11B**, the customer service wires **808, 810** are electrically connected in the terminal block.

As shown in the figures, the terminal block includes a housing including a base **812** and a movably mounted service wire connector member **814** as well as a switch including a select module **816**. A plurality of stations including select modules **816** in a second portion of the base **812** and service wire connector members **814** in a first portion of the base **812**. Portions of three distinct termination stations are shown in **FIGs. 10A, 10B, 11A,** and **11B**.

Tip in line **806** is received and electrically connected to connector **820** at a first end thereof and ring in line **802** is received and electrically connected to connector **818** at a first end thereof. The connector **820** is further electrically connected by a line **848** to an associated intermediate connector **826** and the connector **818** is connected by a line **850** to an associated intermediate connector **828**. The intermediate connector **826**, in turn, as illustrated in **FIG. 10A** connects through a jumper conductor **832** to the tip out connector **824** while the intermediate connector **828** is shown electrically connected by a jumper conductor **830** to the ring output connector **822**. The ring out line **800** is connected to the ring out connector **822** and the tip out line **804** is connected to the tip out connector **824**.

Each of the tip and ring in connectors **818, 820** provides a tip and ring conductor service wire connector portion on an opposite end thereof and electrically connected to the respective connector portions in the bottom of base **812** which receive tip in line **806** and ring in **802**. The respective service wire connector portions, shown as insulation displacing connectors in the figures, are positioned on ends of the connectors **818, 820** to receive the customer telecommunication service wires **808, 810**.

A switch assembly is provided by select modules **816** in combination with jumper conductors **830, 832** and intermediate connectors **826, 828**. The intermediate connectors **826, 828** respectively are positioned adjacent the tip and ring output connectors **824, 828** in a second portion of the base **812** with the select module **816** positioned over the respective conductors **824, 826, 822, 828**. The select module **816** has a first position electrically connecting the respective conductors **824, 826, 822, 828**, as shown in **FIG. 10A**, and a second position as shown in **FIG. 10B**, wherein the respective connectors are not electrically connected.

The jumper conductors **830, 832** are mounted in the housing of the select module **816**. As shown in the figures, the jumper conductors **830, 832** include long

and short respective ends for providing an electrical connection to both of the connector pairs **824, 826** and **822, 828** in the **FIG. 10A** position while not making this electrical connection in the second position, as shown in **FIG. 10B**.

As is further illustrated in **FIGs. 10A** and **10B**, the select modules **816** include handles **860** which include arrow designations wherein an arrow pointed out indicates a connection to the respective tip and ring out lines **804, 800** and an arrow designation facing in towards the service wire connector member **814** indicates the connection not being made to the output lines **800, 804**.

The service wire connector member **814** is shown positioned in a second portion of the base **812** adjacent the first portion including the select module **816**. The base **812** includes a chamber **844** which may include an environmental sealant material, such as a gel, to provide environmental protection to the service wire connection portions of the connectors **818, 820** which are positioned above the bottom wall **856** of the housing **812**. Note that the top face of the bottom wall **856** defines an upper surface of the base **812** with reference to the service wire connector member **814** and the select module **816**. In addition, a chamber **842** is defined by the base **812** which may be potted or otherwise environmentally sealed to provide environmental protection to the connections to the respective tip and ring in and output lines **800, 802, 804, 806** as well as the intermediate connections shown in **FIGs. 10A, 10B, 11A,** and **11B**. An environmental sealant may further be provided in the chamber **846** defined by the housing of the select module **816** to provide environmental protection to the upper portion of the connectors **822, 824, 826, 828** and the jumper conductors **830, 832**.

The service wire connector members **814**, as shown in **FIGs. 10A, 10B, 11A,** and **11B**, include a service wire passageway (**834** shown) for each of the tip **810** and ring **808** service wires which passageway includes respective openings **836**. In a rotated open position, the opening **836** is presented above the top **854** of the base **812** in a manner facilitating insertion of a service wire **808, 810** into the respective passageway through the corresponding opening. In the closed position

illustrated as shown in **FIGs. 10A, 10B, 11A,** and **11B**, a portion of the respective service wire receiving passageway **834**, passes through the insulation displacing connector opening in the service wire connector portion of the connector **818** to establish an electrical connection therebetween when the service wire connector member **814** is rotated from the open, wire receiving position to the illustrated closed position. The service wire connecting member **814** further includes an actuation handle **862** and a latch mechanism **852**. The base **812** further may include a cover **854** which defines an upper surface of the chamber **844**.

As is clear from **FIGs. 10A, 10B, 11A,** and **11B**, the service wire connector member **814** may be rotatably or otherwise removably mounted in the base **812** to provide for establishing a connection between the connectors **818, 820** and the service wires **808, 810**. Furthermore, as shown by comparison between **FIG. 10A** and **10B**, the select module **816** may be provided with the first and second position being opposite orientations relative to the housing **812** such as the substantially 180° rotation between the two orientations shown in **FIGs. 10A** and **10B**.

Referring now to **FIGs. 11A** and **11B**, embodiments of the present invention including an electrical protection device **870** will be further described. A ground conductor **872** is provided in the portion of the base **812** adjacent the select module **816**. The electrical protection device **870** is positioned in the chamber defined by the housing of the select module **816**. As illustrated in **FIG. 11A**, electrical protection generally referred to as three point protection may be provided by a gas tube **870** having a terminal connected to each of the respective tip and ring lines through the respective intermediate portions of the jumper conductors **830** and **832** as well as a centrally disposed ground connection point to the ground conductor **872**. The use of electrical protection devices such as gas tubes is generally known to those of skill in the art and will not be described further herein. Note that, as illustrated in **FIG. 11B**, the protection circuit is provided to the tip and ring input lines **802, 806** and the customer service wires **808, 810** but is not connected to the tip and ring output lines **804, 800**. Note that **FIG. 12** illustrates

embodiments in which a protector is provided without tip and ring output lines being provided.

Referring now to **FIG. 13**, further embodiments of the present invention providing a terminal block for making and breaking connections between a telecommunications conductor and a service wire will be described. As shown in **FIG. 13**, the tip input line **806** is electrically connected to the connector **824** while the ring input line **802** is connected to the connector **822**. The connector **824** is, in turn, connected to the intermediate connector **826** through an electrical protection device **884** which is electrically connected between the respective connectors **824, 826** by a jumper conductor **886**. Similarly, the electrical protection device **880** is electrically connected between the connectors **822** and **828** by a jumper conductor **882**. Accordingly, the respective electrical protection devices **884** and **880** are placed in series on the respective tip and ring input lines **802, 806** which, in turn, connect through the electrical connection lines **848** and **850** to respective connectors **818, 820** and, thus, to the customer telecommunications service wires **808, 810**. As a result, when combined with a three point protection device, such as the gas tube described previously, five point protection may be provided for the tip and ring telecommunications circuit.

The electrical protection devices **880, 884** may be fuse circuits, such as a fuse or a fusable link. Thus, under selected over-voltage or over-current conditions, in lieu of, or in addition to, a ground path through a device such as a gas tube, the connection of the incoming tip and ring lines to the customer service wires may be opened. Note that the common elements of the terminal block illustrated in **FIG. 13** otherwise operate substantially as described previously with respect to **FIGs. 10A, 10B, 11A, 11B** and **12** and will not be further described herein.

Referring now to **FIG. 14**, an exploded perspective view is provided showing a multi-station terminal block according to embodiments of the present invention including a plurality of termination stations along the elongate axis

defined by the base **812** to support a plurality of wire pairs from the telecommunications conductor cable **105**. The respective service wire connector members **814** and select modules **816** operate generally as described previously with respect to various embodiments. As shown in **FIG. 14**, a total of 25 termination stations are provided, each supporting one tip and ring wire pair. A further embodiment is illustrated in **FIG. 15** wherein a 50 pair cable may be supported by 50 respective service wire connector members **814'**, pairs of which are supported by a respective one of 25 select module stations **816'** positioned in the base **812'**.

Yet further embodiments of the present invention will now be described with reference to **FIGs. 16A** and **16B**. The service wire connector member **914** is configured to receive the customer telecommunications service wires **808, 810** in substantially the manner described previously with reference to **FIGs. 10A** and **10B** so as to provide an electrical connection to the service wire connector portions of the respective connectors **818** and **820** mounted in the base **912**. The tip and ring in lines **806, 802** are connected at connection portions on a first end of the respective connectors **818, 820** in a lower chamber, defined by the housing **912**, which may be environmentally sealed, such as by potting. A jumper connection **918** between one of the connectors **818** and an intermediate connection point **920** is shown in the figures. A similar connection would be provided for the connector **820**. The intermediate connector **920** has an associated ring line output connector **926** (see also tie line connector **931**) which, in turn, is connected to the respective ring output line **804** (see also tie output line **800**). The intermediate switch portion **922** provides a selectable electrical connection between the intermediate connector **920** through the conductive member **924** to connect through the connector **926** to the ring output line **804**. The tip output line **800** is similarly connected through intermediate switch portion **928**.

As shown in **FIG. 16A**, the select module **916** providing the switch for the illustrated terminal block includes a housing **932** and an actuator **934**. The

transition between the input and output connected configuration shown in **FIG. 16A** and the open configuration shown in **FIG. 16B** may be provided, for example, by a slidable actuator configuration of actuator **934** or by a removable housing **932** which may be reinserted in a 180° rotated position in which the intermediate members **922, 928** are allowed to move, for example, due to a spring pre-load, to an open position breaking the electrical connections when an actuator lip **934** is moved to the opposite end and out of contact with the intermediate switch portions **922, 928**.

Referring now to **FIG. 17A** and **17B**, further embodiments of terminal blocks according to the present invention will now be described. The terminal block includes a base **750** including tip and ring in connectors **820, 818** mounted in a first portion thereof and extending from an upper surface of the base **750**. A respective tip and ring output connector **766, 768** is mounted in the second portion of the base **750**. The movably mounted service wire connector member **776** is positioned adjacent the upper surface of the base **750** in the first portion. The service wire connector member **776**, as shown in **FIG. 17A**, is pivotally mounted and includes a latch **778** as well as a service wire receiving passageway **779** having an opening **781** and a slot portion **780** crossing the passageway **779**. The service wire receiving passageway **779** and opening **781** and slot **780** for receiving the connector **818** operate substantially as described previously with reference to **FIG. 10A**.

A contact member **770** extends from the output connector **768** in the second portion of the base **750** and extends from the base **750** to a second end **772** having a contact point **774** at an end thereof which is, as shown in **FIG. 17A**, positioned in contact with the service wire connector portion of the connector **818**. An actuator **782** is positioned in the service wire connector member **776** so as to allow the contact member **770** to contact the connector **818** in the position illustrated in **FIG. 17A** and to break the contact between the contact member **770** and the connector **818** in the position of the service wire connector member **776** illustrated in **FIG.**

17B. As shown in **FIGs. 17A** and **17B**, the actuator **782** is provided as a cam surface with a sloped portion engaging connector **818** to displace it from the contact point **774** of the contact member **770** as illustrated in **FIG. 17B** while allowing the connector **818**, for example, through spring loading, to return into engagement with the contact point **774** in the position shown in **FIG. 17A**. Accordingly, insertion of customer service wires into the passageway **779** and rotation of the service wire connector member **776** into the closed position both establishes a connection between the input lines **802, 806** and the customer service wires **808, 810** and breaks the connection between the respective input **802, 806** and output **800, 804** lines.

Operations for making and breaking connections with a telecommunications conductor according to embodiments of the present invention will now be described with reference to the flowchart illustration of **FIG. 18**. It is to be understood that, while the methods of the present invention may be accomplished utilizing the terminal blocks of the present invention, other hardware may be utilized in keeping with the methods of the present invention.

Operations begin at block **1000** when X pairs of telecommunications conductor wires from a telecommunications conductor cable extending from a central office facility are severed, for example, at a splice. X pairs may be 25 pairs for a typical application utilizing a telephone company pedestal. The telecommunications conductor cable has more than X pairs of telecommunications conductor wires. A first end of the severed X pairs of telecommunications conductor wires, such as the end connected to a telephone company central office, is connected to a first group of X pairs of wires (block **1005**). The second end of the severed X pairs of telecommunications conductor wires is connected to a second group of X pairs of wires, such as those extending downstream away from the central office (block **1010**). The first and second group of X pairs of wires are extended to a telecommunications customer service wire junction box, such as a telephone company pedestal (block **1015**).

Ones of the first group of X pairs of wires are selectively connected to at least one of a pair of customer service wires or one of the second group of X pairs of wires in the customer service wire junction box as will be described for particular embodiments with reference to blocks **1020** and **1025**. As shown in **FIG. 18** selective connecting operations may include connecting selected ones of the first group of X pairs of wires to a pair of customer service wires and leaving corresponding ones of the second group of X pairs of wires disconnected from ones of first group of X pairs of wires which are connected to a pair of customer service wires to interrupt the through connection (block **1020**). Corresponding ones of the second group of X pairs of wires may be connected to ones of first group of X pairs of wires which are not connected to a pair of customer service wires (block **1025**).

The foregoing is illustrative of the present invention and is not to be construed as limiting thereof. Although a few exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the claims. In the claims, means-plus-function clauses are intended to cover the structures described herein as performing the recited function and not only structural equivalents but also equivalent structures. Therefore, it is to be understood that the foregoing is illustrative of the present invention and is not to be construed as limited to the specific embodiments disclosed, and that modifications to the disclosed embodiments, as well as other embodiments, are intended to be included within the scope of the appended claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.